

A HERPETOFAUNAL INVENTORY OF BUFFALO NATIONAL RIVER



Figure 1. Spiny Softshell turtle

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Summary

Prior to 2002 only cursory surveys of herpetological species had been performed in isolated areas of Buffalo National River. Kimberly Coates (1986) collected salamanders from seven locations along the river, between Hwy 43 and Hwy 7. Trauth (1993) sampled the Turkey Mountain area prior to prescribed fire for glade restoration. Wiggs (1994) surveyed Cecil Creek and Ponca wilderness to gather baseline data for Gypsy moth control on forested lands adjacent to Buffalo National River. Trauth (1998) searched for Queen Snakes and Ozark Hellbenders but located none in his study. Those limited surveys, however intriguing, did not provide enough information to allow park managers to make appropriate decisions to insure long term sustainability of herpetofaunal species and abide by the NPS mission statement. Our survey, conducted between March 2002 and September 2003, of the Buffalo National River and select portions of the BUFF watershed involved general visual searches, river surveys via boat, day and night road cruising, and special habitat searches. The survey yielded 60 species of reptiles and amphibians. Nine (9) additional species are reasonably expected to occur within the BUFF watershed but due to specific habitat requirements or incorrect range delineation these were not located in the study. Undeveloped portions of the BUFF watershed retain a rich diversity and abundance of herpetofauna. Current good management practices and our proposed recommendations should insure long term viability of sustainable populations of herpetofauna within Buffalo National River.



Figure 2. Glade above Dark Hollow

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Introduction

Congress passed the National Parks Omnibus Management Act in 1998 in response to concerns about the condition of natural resources within the national parks. The act requires each park to gather baseline inventory data on pertinent natural resources, data that will provide a pivotal step toward establishing an effective monitoring program furthering the ability to effectively manage and protect park resources. The National Park Service (NPS) responded with the Natural Resource Challenge program, including the establishment of biome-based inventory and monitoring networks. The Heartland Network, as part of the NPS Inventory and Monitoring (I&M) program, has undertaken inventories of vascular plants and vertebrates within fifteen parks in eight Midwestern states. Stemming from this challenge and a widespread concern regarding the status of herpetofauna populations at Buffalo National River (BUFF), an inventory process was established to determine resident amphibians and reptiles.

Previous herpetological inventories of Buffalo National River were spatially isolated and lacking in overall coverage of species composition, distribution, and abundance. A comprehensive inventory was deemed necessary to establish baseline data of herpetofaunal resources within BUFF to provide information to make sound resource management decisions.

Much of the natural habitat of northern Arkansas has been altered and or fragmented by agricultural and timber harvesting operations which may have negative impacts on



Figure 3. Prescribed fire

herpetofaunal diversity and populations (Blaustein et al. 1994, Pechmann and Wilbur 1994). The Buffalo River is the largest free flowing river in the North Central Arkansas Ozark highlands and is protected by legislation against extreme degradation due to run off from land clearing practices and logging operations. The BUFF and Adjacent USFS wilderness lands provide an island-like refuge (albeit a narrow corridor) within the Ozark highland ecosystem.

BUFF management practices are presently in place to restore glades, open old field systems, and to control exotic plant species. Prescribed fire is one

management tool currently being implemented to restore and maintain ecosystems and historical mosaic landscapes using multiple stages of succession to restore habitat structure and promote desirable vegetative species. Russell et al (1999) suggests that herpetofaunal

species benefit from fire induced reduction of forest canopy cover that creates breeding habitat.

Our objective for the comprehensive two-year inventory, spanning 2002 – 2003, was the documentation of 90% of reptile and amphibian species reasonably expected to occur at BUFF. The goals included providing an assessment of species richness, estimating relative abundance and local ranges, and collecting voucher photo records for future comparison of status and health of herpetological resources.



Figure 4. Common Snapping Turtle



Figure 5. Bullfrog Tadpole - 6 1/2 inches

Study Area

Buffalo National River is located in the Ozark highlands of north central Arkansas. Its headwaters are in the Boston Mountains of Newton County. The river generally flows to the north and east for 135 miles through portions of the Springfield Plateau to join the White River in the Salem Plateau, south of Mt. Home, Arkansas. The 95,730 acre national river contains 3



Figure 6. Buffalo National River

designated wilderness areas within its boundaries. The park ranges in width from less than one-half mile to 7 miles at the widest point. U.S. Forest Service designated wilderness areas adjoin either end of the park land and an 18,000 acre Arkansas Game & Fish Wildlife Management area shares a boundary with the NPS land near the center of the corridor.

The Buffalo River is a clear seasonally dependent, tributary fed, stream. The river lacks the large oxbows and sloughs

found in slow flatland rivers and may lack some of the habitat qualities necessary for some species of turtles. Most resident species of aquatic reptiles and amphibians are relatively abundant.

The area receives about 45 inches of annual precipitation, seasonally heavier in the spring and generally heavier at higher elevations. Temperatures generally range between 0°F and 100° F. The elevation within the BUFF boundary ranges between 2380' in the upper river to 365' at the mouth at the White River.

Habitat potential along the river corridor is varied. The riparian areas are comprised of sycamore, box elder, silver maple, and river birch. Giant river cane is also present in those areas that have been disturbed or that have been



Figure 7. Glade in Lower Wilderness Area

burned due to *Arundinaria gigantea*'s special requirements (Sagers and Lyon 1996 and



Figure 8. Hay Field



Figure 9. Cave Habitat

Hughes 1957). Old fields in various stages of succession contain numerous forbs and grasses with persimmon, honey locust, sweet gum, eastern red cedar, sassafras, and sumac predominating tree forms. Special use permitted hay fields generally support native and exotic vegetation including clover, orchard grass, Bermuda grass, Johnson grass, lespedezas, and fescue. Glade and savanna ecosystems are sporadically encountered on ridges and hillsides in addition to the climax oak, hickory, and pine upland forest. The shallow soils and often exposed bedrock of glades offer glimpses of natural prairie and xeric communities and provide unique habitats for many varieties of herpetofauna.

Sandstone and limestone substrate predominate the underlying bedrock. Karst features are found throughout Buffalo National River. The caves, springs, and seeps associated with karst features are an intricate part of the multifaceted habitat profile of the river and are fundamentally important to special requirements of many species of amphibians.

At present the leading causes for concern in the Buffalo River Watershed are extraction of forest products, chemical applications to surrounding agricultural developments, and the siltation and pollution associated with those practices. Those actions may impact biological regimes within the park, now or at some future date. Tourism within the park is seasonally heavy with the majority of the 750,000 visitors using the park during the warmer months. That period coincides with peak herpetofaunal activities and may influence the detection of some species, especially river turtles, but probably has

little impact on the overall welfare of most species. Possible overuse and exploitation of underground resources (e.g. caves and springs) could be the exception, but at present only a few caves receive routine visitation and use by the public.

Materials and Methods

The inventory process was initiated in early spring 2002 and progressed through late summer 2003. This time frame allowed 2 spring sampling periods for cool season active amphibians, 2 summer seasons for river species, reptiles and warm season amphibians, but only 1 autumn period for fall breeding species (e.g. *Ambystoma annulatum*, ringed salamander).

Primary terrestrial methods included road cruising (Karns 1986) and general search and seizure methods, rock and log turning with potato rake and by hand (Droege 2002). Aquatic methods using dip nets and visual encounter searches (VES) of shoreline, shallow water, and basking sites



Figure 11. Ringed Salamander

were also employed (Droege 2002). A modified quadrant sampling approach (Jaeger 1980) was utilized to establish points along the river for time constrained searches [TACS] (Campbell and Christman 1982, Morrison et al 1995). Portions of the river we could



Figure 10. River Habitat

reasonably inventory which offered repeatability over time were selected and divided into sections (miles). This is our equivalent to Geissler's (2002) grid cells. An attempt was made to survey at least one plot of 30m² per mile section of river. If suitable habitat was not located at the designated plot, the closest desirable habitat would be selected. These plots were carefully searched for a minimum of 30 minutes via VES, dip net, or by hand. In some cases more than one plot per mile was established if exceptionally desirable

habitat was encountered. All animals observed at any location during the survey were tabulated.

Unique areas of the park were targeted for specialized surveys (Droege 2002). Caves



Figure 12. Spotted Salamanders under log



Figure 13. Pond Habitat

(n=25), springs and seeps (n=16), glades (n=6), ponds (n=35), and old field systems (n=7) were targeted for specialized inventories in addition to general terrestrial and river surveys. These one of a kind habitats were selected based on the survey team's prior knowledge of the park's resources and habitat variables. Each primary location, whatever the technique employed, was recorded using a Trimble Geoexplorer3 handheld unit. A minimum of 100 points were collected for each position and those were differentially corrected to insure the highest possible accuracy. Files were saved as ArcView shapefiles and are stored on CD.

Due to the sensitive nature of cave environments, which may contain threatened & endangered species, some specific cave locations were not plotted. General information regarding cave locations is available through the BUFF resource management division geologist if it is deemed necessary to repeat these surveys.

An expected species list was compiled prior to initial inventory proceedings based on Trauth (2000), Johnson (1987), Conant (1975), and the authors' professional experience

and prior knowledge of the BUFF watershed. Most common and scientific names are based on Moriarity (2000).

Photo-documentation of specimens were collected where possible and collated to serve as validation records (Droege 2002). Over 700 photographs were taken. All assigned accession numbers were entered into Microsoft Access database for reference and will be available through NPS heartland network or BUFF resource library in CD format.

No specimens were harmed or injured during this inventory survey. Habitat disturbance was kept to a minimum and all habitat structure and arrangements were left intact or returned to the original positions (i.e. rocks and logs returned to original orientation).

Results

Expected Species

An expected species list of 69 total species was generated with 25 amphibians and 44 reptiles (Table 1. Species Expected and Abundance).

Species Richness and Abundance

The inventory yielded 22 amphibian species (10 salamanders and 12 anurans) and 38 reptilian species (9 turtles, 7 lizards, and 22 snakes). Relative abundance tables are provided in Table 1. Species Expected and Abundance by Taxonomy. Species occurrence by habitat is shown in Table 2. Species By Habitat Type. Distribution maps of reptiles and amphibians inventoried are included in the appendix of this report.

Five herpetofaunal species that are found within BUFF are recognized by Arkansas Game & Fish Commission as species in need of special protection (Irwin 2003). They are the ringed salamander, grotto salamander, wood frog, alligator snapping turtle, and eastern box turtle. All five of those were found during this inventory. All but the alligator snapping turtle appear to have sustainable populations within the BUFF watershed.

Discussion

Buffalo National River, with the exceptions of the Ponca and Lower Buffalo wilderness areas, is a very narrow corridor and due to certain habitat preclusions may not represent a full range of herpetofauna to be expected in the southern portion of the Ozark uplift. With 88% of the total number of expected species tabulated, and observing no anomalies, aberrations, or unexplained mortality during the survey we feel the health and viability of the herpetofaunal complement is extremely positive.

Amphibians

Of the 25 amphibians expected, 3 were not located in the survey. The marbled salamander (*Ambystoma opacum*) was previously documented (Coates 1986, Wiggs 1994) in the Ponca wilderness/Cecil Creek area. This may be a small isolated population representing an extension of the previously known range. This area wasn't included in this terrestrial inventory due to previous survey coverage. No other marbled salamanders were observed during this survey.

The tiger salamander (*A. tigrinum*) and Eastern Narrow-mouthed toad (*Gastrophryne carolinensis*) have never been documented in the Buffalo National River area by the authors. This may be due to specific habitat deficiencies.

The mudpuppy (*Necturus maculosus*) has been previously observed only twice by the authors while floating the Buffalo River. There is also a mudpuppy specimen housed in the NPS museum collection at BUFF, misidentified as a hellbender. None were collected during the present inventory and only one was briefly observed before disappearing into a deep pool of water. Very little information about mudpuppy populations can be extrapolated from these few limited sightings but since they require clean unpolluted water it can be assumed the Buffalo River is still relatively unpolluted.

The green treefrog (*Hyla cinerea*) has been observed in recent years at the Buffalo Point campground in the lower Buffalo River. These individuals have apparently been introduced via hitchhiking on RVs from other areas of the south and east. Thus far they have not become a viable population in this locale and so weren't added to the expected species list.

None were recorded during this survey but they have been noted sporadically by the authors throughout the past 15 years.

Reptiles

Of the 44 reptiles expected, 6 were not located during the survey.

The ornate box turtle (*Terrapene ornata*), a prairie species, has been identified from prehistoric records, but native prairie ecosystems in Northern Arkansas and especially near the BUFF have been degraded and highly fragmented to such an extent that acceptable habitat no longer exists for ornate box turtles. Consequently none were expected or found. The slender glass lizard (*Ophisaurus attenuatus*), another prairie species, was expected but not found presumably for similar reasons.

Highly variable phenotypic variation was noted with many river turtle species. After reviewing current literature on identification and nomenclature (Moriarity 2000, Johnson 1987, Conant 1975) it became apparent that there is still considerable work to be done on the understanding of classification in Midwestern river turtles. Some specimens observed had characteristics of both cooters (*Pseudemys*) and sliders (*Trachemys*) but upon closer inspection they more reasonably fit river cooter classification. These may be regional variations in phenotype or subspecies of *Pseudemys*. It was our determination that they weren't *Trachemys*.



Figure 14. Ouachita Map Turtle

The red eared pond slider (*T. scripta*) is found in adjacent areas of the region and should reasonably be expected to occur at BUFF however no adult or juvenile red-eared sliders were identified by this survey. One possible observation was noted at the old mill pond in Boxley valley but couldn't be confirmed.

Confusion exists regarding saw backed varieties of turtles. The only inventoried turtle with a prominent keeled ridge on the carapace was *Graptemys ouachitensis*, the Ouachita map turtle. The Mississippi map turtle (*G. pseudogeographica kohnii*) is presumed to occur in the region but none were positively identified during the survey.

The alligator snapping turtle (*Macrolemys temminckii*) has rarely been observed in the Buffalo River by the authors and has only rarely been collected by fishermen. None were documented by



Figure 15. Alligator Snapping Turtle

the survey team, however, one large adult (98 lbs.) was captured by fishermen trot lining for catfish near Maumee. It was photographed and returned unharmed to the river. These large turtles are rare in the Buffalo River and may not represent a viable breeding population. Only a few large adults and no juveniles have been noted in Buffalo National River in recent years. It is the authors' opinion that these may represent individuals migrating out of the now dammed White River seeking warmer, quieter water or these individuals have been living in the waters of BUFF for many years.

The eastern collared lizard (*Crotaphytus collaris collaris*) was found in 5 glade environments along the river but as the glades become even more fragmented and isolated due to fire suppression the collared lizard populations may diminish. Missouri Department of Conservation (Turner 2002) has documented recolonization of glades by collared lizards following large scale



Figure 16. Eastern Collared Lizard

prescribed fire operations on Stegall Mountain in South Central Missouri. Similar planned prescribed fire management at BUFF includes glade restoration and prescribed fire activities. These measures should be extremely beneficial to maintaining and perpetuating the eastern collared lizard populations and promoting suitable habitat for other glade dependent herpetofauna.

Some glade species may be extremely rare or so seasonally specific not to be encountered in the survey strategies that were employed in this inventory. The scarlet snake (*Cemophora coccinea*) and the Great Plains rat snake (*Elaphe guttata emoryi*) have been found in glade areas near the Buffalo River. None were located during this survey. *Elaphe guttata guttata* (corn snake) has been observed by the authors and other NPS staff within the adjoining Sylamore district of the Ozark National Forest during this inventory period but none were found within BUFF.

The red milk snake (*Lampropeltis doliata*) wasn't found during this survey but it was noted by Trauth (1993) during his lower wilderness herpetofaunal survey of Turkey Mountain. The red milk snake should still be extant within the Buffalo River Valley.

Species Richness and Abundance

Overall species richness for Buffalo National River is quite remarkable given the narrow boundary confines of the park. BUFF is well represented by most (88%) forms of herpetofauna known to exist within the Arkansas Ozark sub region. Old field habitats near wooded areas, and with small fishless ponds, are noteworthy. These ponds seasonally harbor



Figure 18. Bullfrog in Field Pond

exceptional populations of amphibians. Ponds with fish were poorly represented with only two or three species of frogs (bull, green, and cricket) found in limited numbers.

Black rat snakes, racers, prairie and speckled kingsnakes, three-toed box turtles, northern fence lizards, five-lined skinks, southern leopard frogs, Fowler's and dwarf American toads can be found in most large old field



Figure 17. Old Field System



Figure 19. Three-toed Box Turtle

systems. One old field system in particular, recently reclaimed through expired use and occupancy, is a classic example. The 160+ acre tract was visually surveyed as a large single unit. The herpetofaunal representation is typical of old field system diversity, with the exception of 3 farm ponds, and is listed as a separate table (Table 4. Cash Bend – old field system habitat and Figure 31. Old Field System). The ponds were utilized by cattle prior to 2002 and were noticeably lacking in

amphibian diversity and abundance when surveyed. We believe this is due to various chemical insecticides applied to the cattle to control flies and parasites. These chemicals

were then delivered to the ponds by wading cows, thus creating an almost sterile environment. This situation is being monitored by NPS habitat crews to ascertain the implications and effects of pesticide application on livestock near water.



The aquatic herpetofaunal species found in the river are a typical representation of a large Ozark highland stream and most are relatively abundant. Map turtles, river cooters, midland water snakes, cottonmouths, bullfrogs, green frogs, and cricket frogs are found in high numbers throughout the entire river.

The upland oak/hickory/pine forest



held no surprises in species composition or abundance. BUFF forested land is representative of un-harvested and now essentially old growth forest. Most amphibians are associated with springs, seeps, and small watercourses. Commonly observed animals in that habitat

Figure 20. 2 Cottonmouths

included dark sided, Ozark zigzag, and cave salamander as well

as wood, pickerel, and bronze frogs. Fence lizards, five lined and ground skinks, black rat snakes are often found among the decaying logs and leaf litter that are encountered in old growth habitat types.

Karst features are possibly the most potentially threatened ecosystem but at present appear secure and healthy within BUFF. Amphibians associated with caves, springs and seep areas are commonly encountered and often numerous. Other surveys are presently being



Figure 21. Seep Habitat



Figure 22. Dark-sided Salamander



Figure 23. Newt - Red Eft Stage

conducted for inventory and monitoring of caves and springs within BUFF. The underground water shed will need constant surveillance and monitoring to insure continued healthy populations of herpetofaunal resources.

The broad spectrum of a variety of specific and general habitats within BUFF is the leading factor for such species diversity and relative abundance of many of the herpetofauna observed. Habitat restoration projects and prescribed fire will likely be a positive influence in future species indices. Continued monitoring and habitat management will insure long term sustainable populations of herpetofauna.



Figure 24. Grotto Salamander



Figure 25. Musk Turtle – Stinkpot

Management Recommendations

Based on this inventory the following management actions are recommended.

1) Elimination of fish in small ponds (less than 20 meters in diameter) would add much needed breeding habitat for several species of frogs, toads, and salamanders (especially ambystomids). That would essentially reproduce the fishless woodland ponds and wetlands that would have existed prior to the arrival of European land practices that would have included filling in those, often karst produced, features.



Figure 26. Coachwhip

2) Continue and improve habitat restoration activities, especially glade and prairie enhancement. This will be advantageous for some of Buffalo River's isolated populations of species, including collared lizards and coachwhips, and will benefit other glade and prairie dependent species.

3) It is recommended that studies of the status of the timber and pygmy rattlesnakes be conducted in more detail, by appropriate agencies, to ascertain if those animals should be afforded special protection in Arkansas. Although they aren't rare within the BUFF watershed they have become exceedingly rare and in some cases completely extirpated over much of their former range. The rocky backwoods of BUFF along with adjacent US Forest Service lands are areas of concern for those snakes.



Figure 27. Pygmy Rattlesnake

4) The alligator snapping turtle, presently protected by AG&FC regulations in Arkansas, isn't on the threatened and endangered (T&E) list (Irwin 2003). We encourage the NPS and AG&FC to seek further protection for this turtle species.

5) We recommend research on classification of river turtle species on the Buffalo River. An exhaustive study of these turtle varieties would benefit our regional understanding and identification of the various species and subspecies located on or near the Buffalo River watershed.

6) We recommend continued monitoring of spring and river water quality to insure adequate standards for herpetofaunal viability.

7) Continue monitoring of herpetofaunal resources for negative impacts of regional developments outside of the park boundaries.



Figure 28. Copperhead

8) An education program for the public and the park staff regarding the benefits of herpetofauna, especially snakes is highly recommended. It has been noted that even seemingly educated park personnel persist in destroying certain snake species on or near the park.



Figure 29. Timber Rattlesnake

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Figure 30. Spotted Salamanders

Appendices

Table 1. Species Expected and Abundance by Taxonomy

Key: +++++ = Commonly Found, + = Rare, ? = Expected But Not Found

Order	Suborder	Family	Species	Common Name	Abundance
Anura		Bufonidae	<i>Bufo americanus charlesmithi</i>	Dwarf American toad	+++
			<i>Bufo fowleri</i>	Fowler's toad	+++
		Hylida	<i>Acris crepitans blanchari</i>	Blanchard's cricket frog	+++++
			<i>Hyla versicolor</i>	Gray treefrog	++++
			<i>Pseudacris crucifer</i>	Northern spring peeper	+++++
			<i>Pseudacris triseriata</i>	Western chorus frog	+
		Microhylidae	<i>Gastrophryne carolinensis</i>	E. narrowmouth toad	?
		Ranidae	<i>Rana catesbeiana</i>	Bullfrog	+++++
			<i>Rana clamitans clamitans</i>	Bronze frog	++++
			<i>Rana clamitans melanota</i>	Green frog	++++
			<i>Rana palustris</i>	Pickereel frog	+++
			<i>Rana sphenoccephala</i>	S. leopard frog	+++
			<i>Rana sylvatica</i>	Wood Frog	+++
Caudata	Salamandroidea	Ambystomatidae	<i>Ambystoma annulatum</i>	Ringed salamander	+
			<i>Ambystoma maculatum</i>	Spotted salamander	+++
			<i>Ambystoma opacum</i>	Marbled salamander	?
			<i>Ambystoma tigrinum</i>	E. tiger salamander	?
		Plethodontinae	<i>Eurycea longicauda melanopleura</i>	Dark sided salamander	++++
			<i>Eurycea lucifuga</i>	Cave salamander	++++
			<i>Eurycea multiplicata griseogaster</i>	Gray-bellied salamander	+++
			<i>Plethodon albagula</i>	Western Slimy salamander	++++
			<i>Plethodon angusticlavius</i>	Zigzag salamander	++++
			<i>Typhlotriton spelaeus</i>	Grotto Salamander	++++
Caudata	Salamandroidea	Proteidae	<i>Necturus maculosus</i>	Mudpuppy	+
		Salamandridae	<i>Notophthalmus viridescens</i>	Central newt	+++++
Squamata	Sauria	Anguidae	<i>Ophisaurus attenuatus</i>	Slender Glass Lizard	?
		Crotaphytidae	<i>Crotaphytus collaris</i>	Eastern Collared Lizard	++
		Phrynosomatidae	<i>Sceloporus undulatus</i>	Fence lizard	+++++
		Scincidae	<i>Eumeces anthracinus</i>	Coal skink	+
			<i>Eumeces fasciatus</i>	Five-lined Skink	+++++
			<i>Eumeces laticeps</i>	Broadhead Skink	+
		<i>Scincella lateralis</i>	Ground skink	++++	

Order	Suborder	Family	Species	Common Name	Abundance
		Teiidae	<i>Cnemidophorus sexlineatus</i>	Six-lined racerunner	++
	Serpentes	Colubridae	<i>Carphophis vermis</i>	Western Worm Snake	+
			<i>Cemophora coccinea</i>	Scarlet snake	?
				Racer	+++++
				Ringneck Snake	+++
				Great Plains rat/corn snake	?
				Black rat snake	+++++
				Eastern Hognose Snake	+++
				Prairie kingsnake	+++
				Speckled kingsnake	++++
				Milk snake	?
				Eastern Coachwhip	++
				Yellow Belly water snake	+
				Midland water snake	++++
				Rough green snake	+++
				Brown snake	+++
				Redbelly snake	+++
Squamata	Serpentes	Colubridae	<i>Tantilla gracilis</i>	Flathead snake	+
			<i>Thamnophis proximus</i>	Western ribbon snake	++
				Common garter snake	++
				Rough Earth Snake	+
				Smooth earth snake	+
			<i>Agkistrodon contortrix</i>	Southern Copperhead	+++
			<i>Agkistrodon piscivorus</i>	Cottonmouth	+++
				Timber Rattlesnake	++
				Western Pygmy rattle snake	++
Testudines	Cryptodira	Chelydridae	<i>Chelydra serpentina</i>	Snapping turtle	++
			<i>Macrochelys temminckii</i>	Alligator snapping turtle	+
			<i>Graptemys geographica</i>	Map Turtle	+++++
			<i>Graptemys ouachitensis</i>	Ouachita Map Turtle	+
				Mississippi map turtle	?
				River cooter	+++++
				Three-toed box turtle	+++++
				Red-eared Slider	?
			<i>Sternotherus odoratus</i>	Musk Turtle (Stinkpot)	+
			<i>Apalone muticus</i>	Smooth Softshell	+
			<i>Apalone spinifer</i>	Spiny Softshell	++

Table 2. Species By Habitat Type

CommonName	Cave and Mine	Spring and Seep	Pond	Glade	River Aquatic	Old Field	Upland Forest
Alligator snapping turtle					X		
Black rat snake						X	X
Blanchard's cricket frog		X	X		X		
Broadhead Skink						X	
Bronze frog		X	X				
Brown snake						X	X
Bullfrog			X		X		
Cave salamander	X	X					
Central newt			X				
Coal skink						X	
Common garter snake						X	
Cottonmouth			X		X		
Dark sided salamander	X	X					
Dwarf American toad						X	
E. narrowmouth toad							
E. tiger salamander							
Eastern Coachwhip				X			
Eastern Collared Lizard				X			
Eastern Hognose Snake					X	X	
Fence lizard				X		X	X
Five-lined Skink				X		X	X
Flathead snake				X			
Fowler's toad						X	
Gray treefrog						X	X
Gray-bellied salamander	X	X					
Great Plains rat/corn snake							
Green frog			X		X		
Grotto Salamander	X	X					
Ground skink						X	X
Map Turtle					X		
Marbled salamander							
Midland water snake					X		
Milk snake							
Mississippi map turtle							
Mudpuppy					X		
Musk Turtle (Stinkpot)					X		
Northern spring peeper			X				
Ouachita Map Turtle					X		

CommonName	Cave and Mine	Spring and Seep	Pond	Glade	River Aquatic	Old Field	Upland Forest
Pickerel frog	X	X					
Prairie kingsnake						X	
Racer				X		X	X
Redbelly snake						X	X
Red-eared Slider							
Ringed salamander			X				
Ringneck Snake						X	
River cooter					X		
Rough Earth Snake				X		X	
Rough green snake						X	X
S. leopard frog			X			X	
Scarlet snake							
Six-lined racerunner						X	
Slender Glass Lizard							
Smooth earth snake				X		X	
Smooth Softshell					X		
Snapping turtle			X				
Southern Copperhead						x	X
Speckled kingsnake						X	X
Spiny Softshell					X		
Spotted salamander			X				
Three-toed box turtle						X	X
Timber Rattlesnake				X			X
Western chorus frog		X	X				
Western Pygmy rattle snake				X		X	X
Western ribbon snake			X			X	
Western Slimy salamander	X	X					X
Western Worm Snake							X
Wood Frog	X	X	X				
Yellow Belly water snake			X				
Zigzag salamander	X	X					X

Table 3. Total Number of Individuals

CommonName	Sum Of Adult	Sum Of Larval	Sum Of Egg
Alligator snapping turtle	1		
Black rat snake	13		
Blanchard's cricket frog	218		
Broadhead Skink	1		
Bronze frog	6	100	
Brown snake	1		
Bullfrog	32	256	
Cave salamander	84	36	
Central newt	866		
Coal skink	1		
Common garter snake	2		
Cottonmouth	30		
Dark-sided salamander	19		
Dwarf American toad	8	1050	
Eastern Coachwhip	1		
Eastern Collared Lizard	13		
Eastern Hognose Snake	3		
Fence lizard	44		
Five-lined Skink	38		
Flat head Snake	1		
Fowler's toad	22		
Gray treefrog	37		
Gray-bellied salamander	6		
Green frog	65	91	
Grotto Salamander	13	23	
Ground skink	3		
Map Turtle	208		
Midland water snake	77		
Mudpuppy	1		
Musk Turtle (Stinkpot)	2		
Northern spring peeper	259	451	
Ouachita Map Turtle	13		
Pickerel frog	15		
Prairie kingsnake	3		
Racer	10		
Redbelly snake	1		
Ringed salamander	17	6	
Ringneck Snake	3		
River cooter	270		
Rough Earth Snake	1		

Rough green snake	2		
S. leopard frog	77		
Six-lined racerunner	2		
Smooth earth snake	1		
Smooth Softshell	6		
Snapping turtle	4		
Southern Copperhead	10		
Speckled kingsnake	5		
Spiny Softshell	10		
Spotted salamander	210	100	289
Three-toed box turtle	23		
Timber Rattlesnake	5		
Western chorus frog	9		
Western Pygmy rattle snake	2		
Western ribbon snake	2		
Western Slimy salamander	59		
Western Worm Snake	1		
Wood Frog	343		
Yellowbelly water snake	1		
Zigzag salamander	20		
TOTAL	3198	2113	289

Table 4. Cash Bend – old field system habitat

SPECIES	COMMONNAME	DATE_	ADULT	LARVAL	EGG	NORTHING	EASTING
<i>Necturus maculosus</i>	Mudpuppy	07/03/2002	1			3981682	518203
<i>Graptemys geographica</i>	Map turtle	07/03/2002	3			3981682	518203
<i>Pseudemys concinna</i>	River cooter	07/03/2002	13			3981682	518203
<i>Rana sphenoccephala</i>	Southern Leopard frog	08/05/2003	13			3981524	517769
<i>Elaphe obsoleta</i>	Black rat snake	05/05/2003	1			3981465	517360
<i>Thamnophis proximus</i>	Western ribbon snake	05/22/2003	1			3981269	517508
<i>Nerodia sipedon</i>	Midland water snake	05/22/2003	1			3981254	517317
<i>Agkistrodon piscivorus</i>	Cottonmouth	05/22/2003	1			3981254	517317
<i>Storeria dekayi</i>	Brown snake	05/22/2003	1			3981073	517604
<i>Eumeces fasciatus</i>	Five-lined skink	08/05/2003	30			3980885	517468
<i>Eumeces laticeps</i>	Broadhead skink	08/05/2003	1			3981774	517641
<i>Nerodia erythrogaster</i>	Yellowbelly water snake	08/05/2003	1			3981439	517544
<i>Terrapene carolina</i>	Three-toed box turtle	08/05/2003	3			3980982	517862
<i>Lampropeltis calligaster</i>	Prairie kingsnake	08/05/2003	1			3980570	517303
<i>Thamnophis proximus</i>	Western ribbon snake	08/05/2003	1			3981240	517249
<i>Coluber constrictor</i>	Racer	08/05/2003	4			3980581	517025
<i>Sceloporus undulatus</i>	Fence lizard	08/05/2003	30			3980925	517394
<i>Rana sphenoccephala</i>	Southern Leopard frog	08/05/2003	7			3980771	516971
<i>Rana catesbeiana</i>	Bullfrog	08/05/2003	0	30		3981260	517297
<i>Elaphe obsoleta</i>	Black rat snake	08/05/2003	3			3980874	516908
<i>Rana sphenoccephala</i>	Southern leopard frog	08/05/2003	50			3981411	516755
<i>Sceloporus undulatus</i>	Fence lizard	08/05/2003	6			3981399	517297
<i>Thamnophis sirtalis</i>	Common garter snake	08/05/2003	1			3981110	517576
<i>Bufo fowleri</i>	Fowler's toad	08/05/2003	1			3981314	517536
<i>Eumeces fasciatus</i>	Five-lined skink	08/05/2003	2			3981354	517323
<i>Acris crepitans</i>	Blanchard's cricket frog	08/05/2003	30			3981308	517269

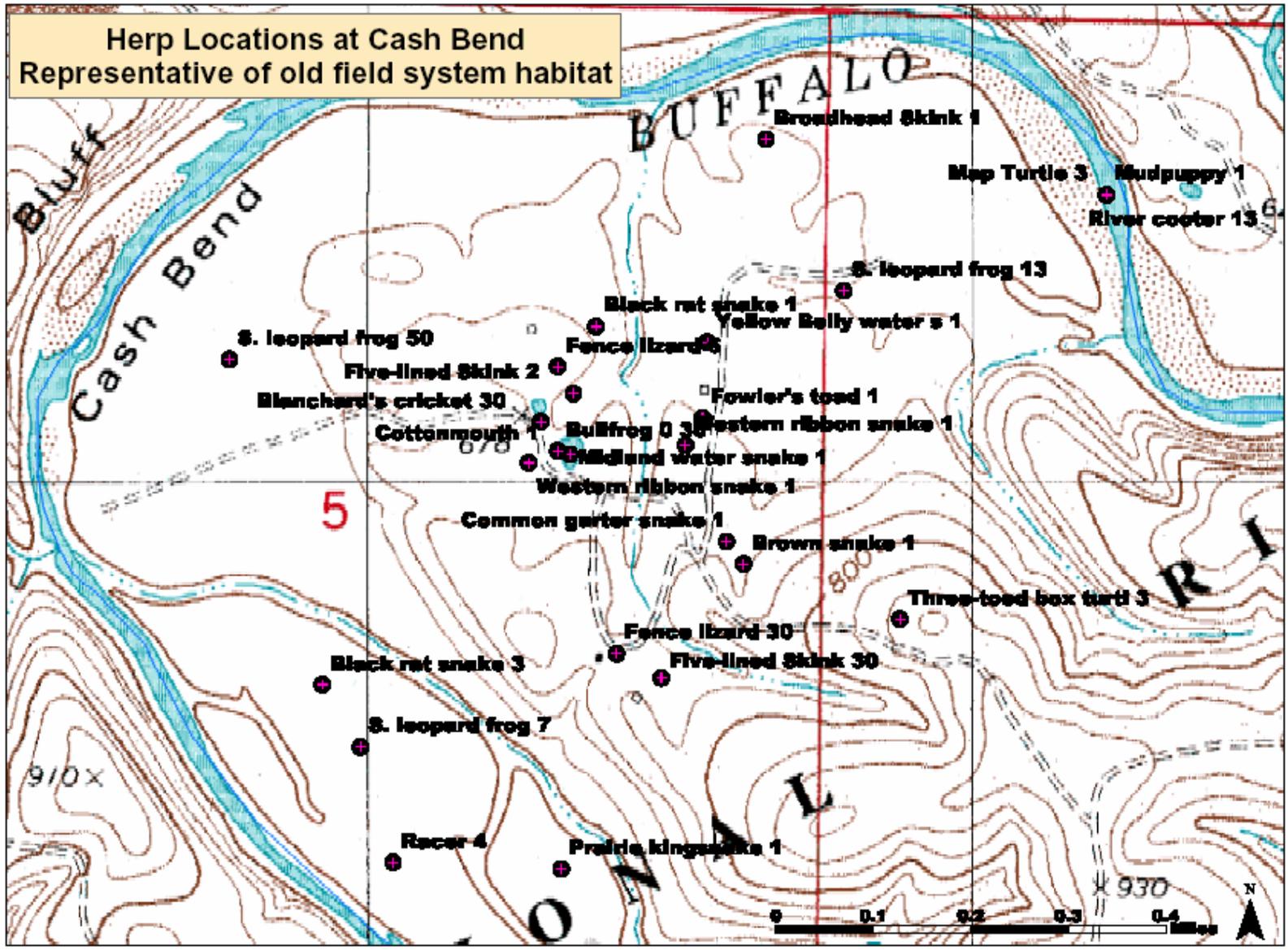


Figure 31. Old Field System

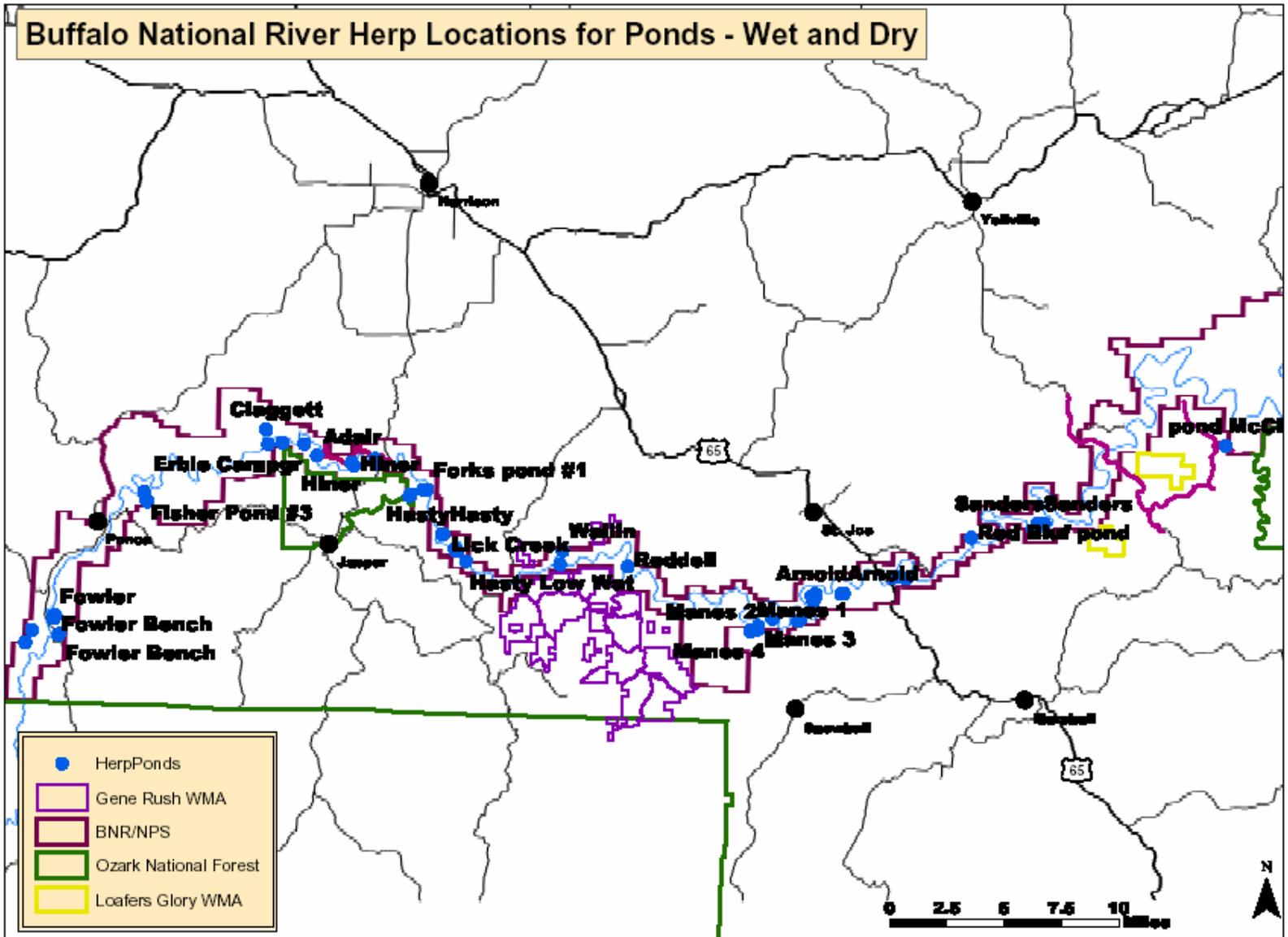


Figure 32. Ponds Surveyed for Herpetological Populations

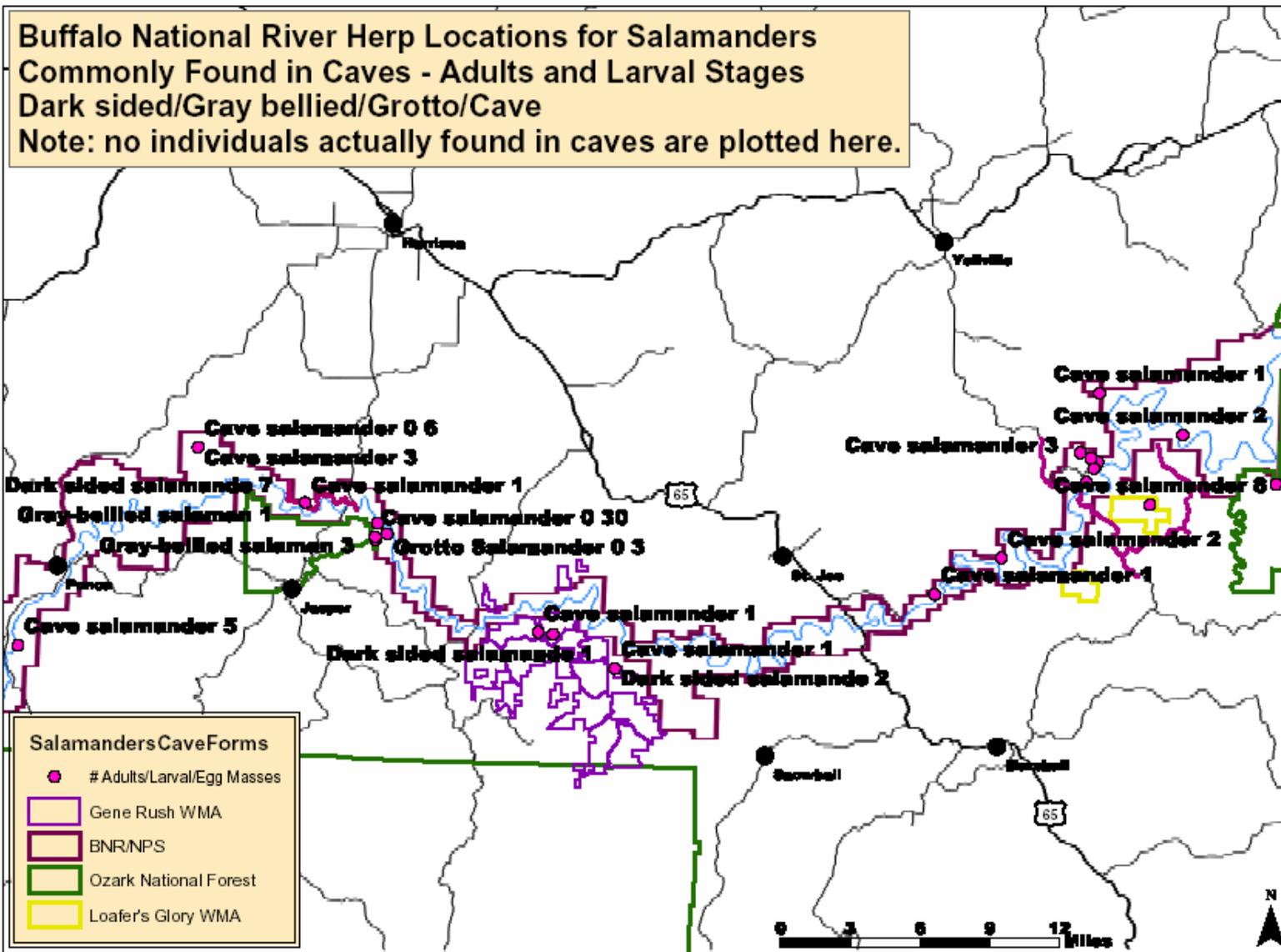


Figure 33. Salamanders - Cave Form - Surveyed Locations

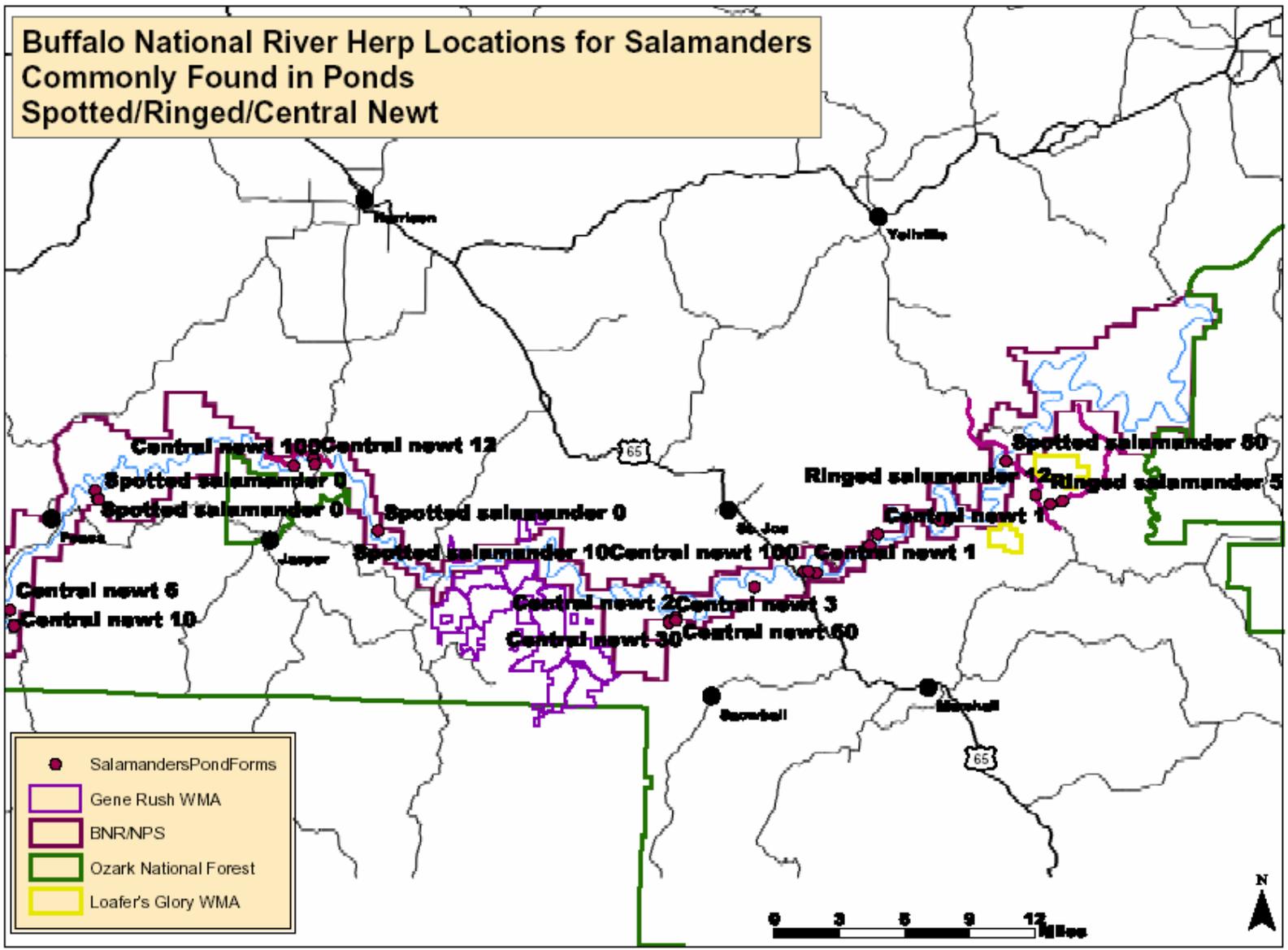


Figure 35. Salamanders - Pond Form - Surveyed Locations

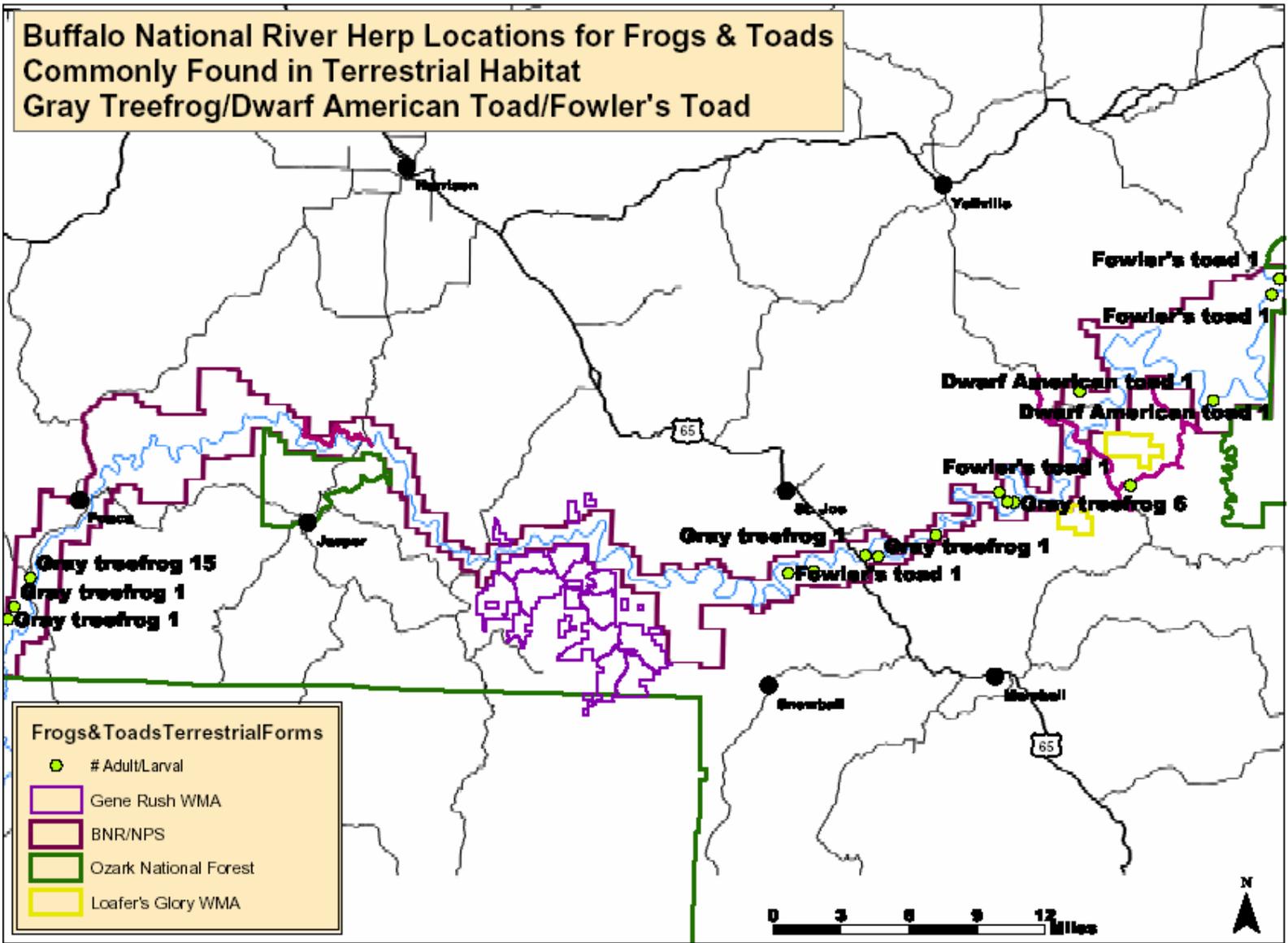


Figure 37. Terrestrial Habitat Frogs

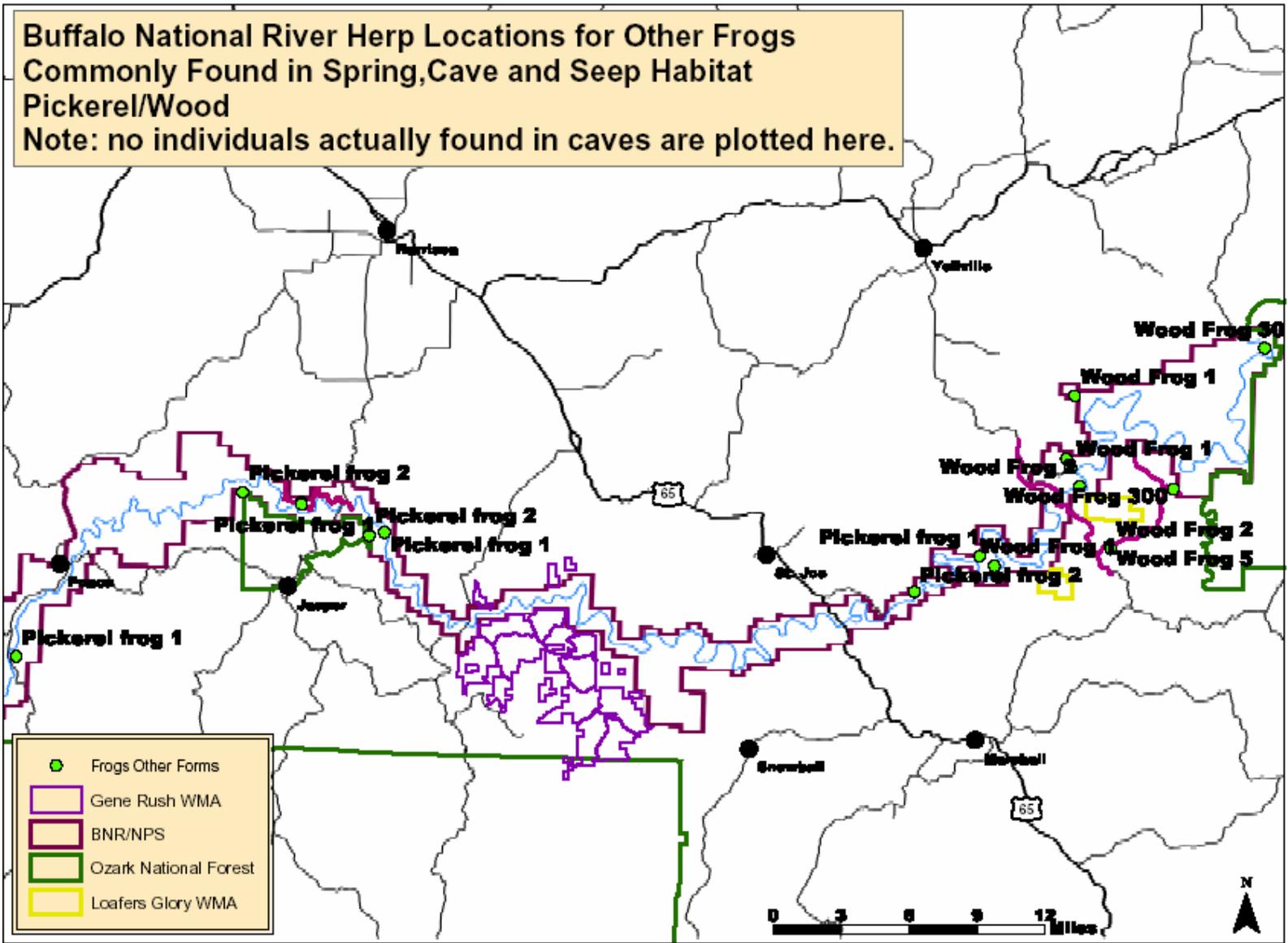


Figure 38. Frogs in Spring, Cave, Seep Habitat

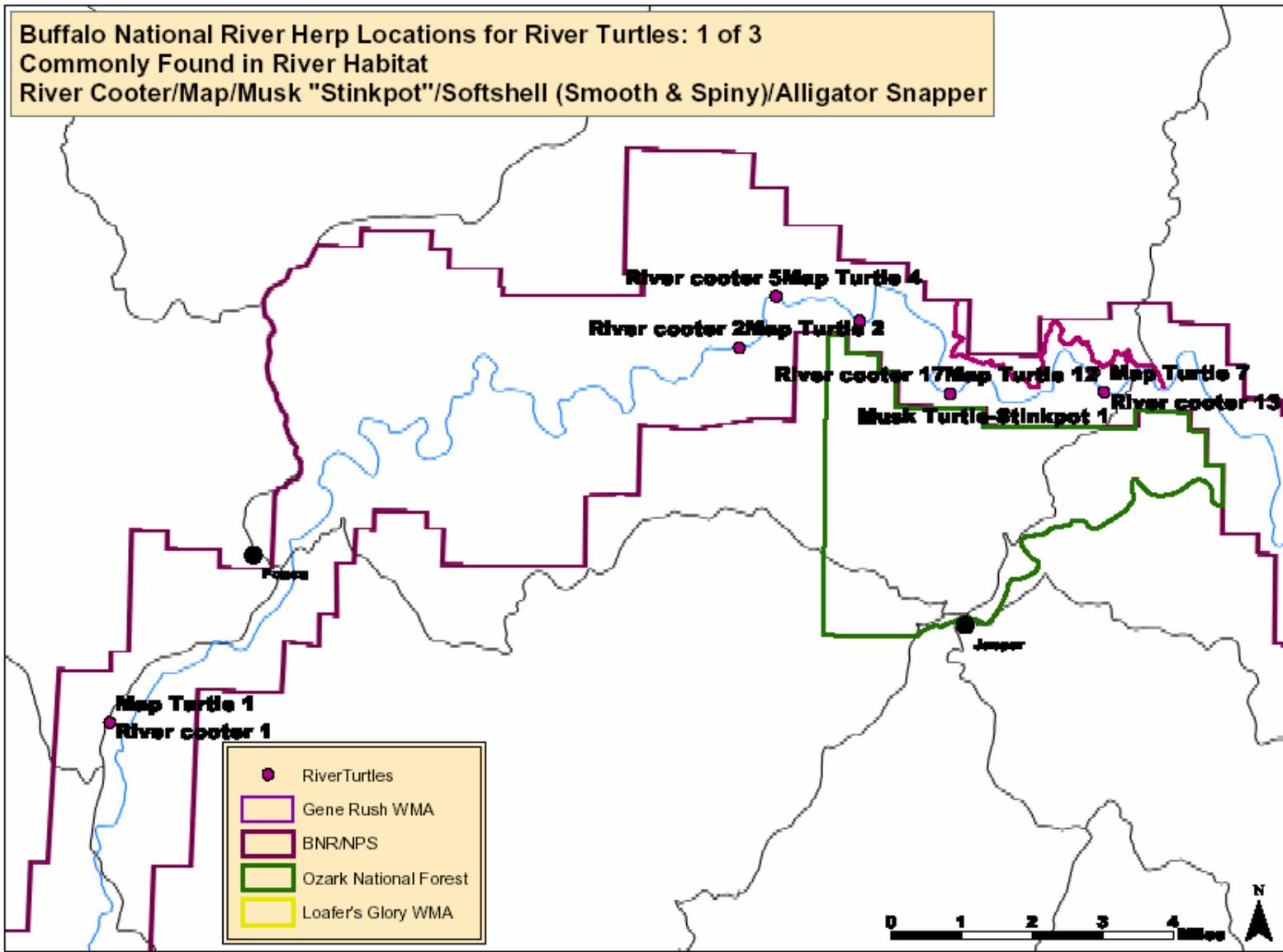


Figure 39. River Turtles 1 of 3

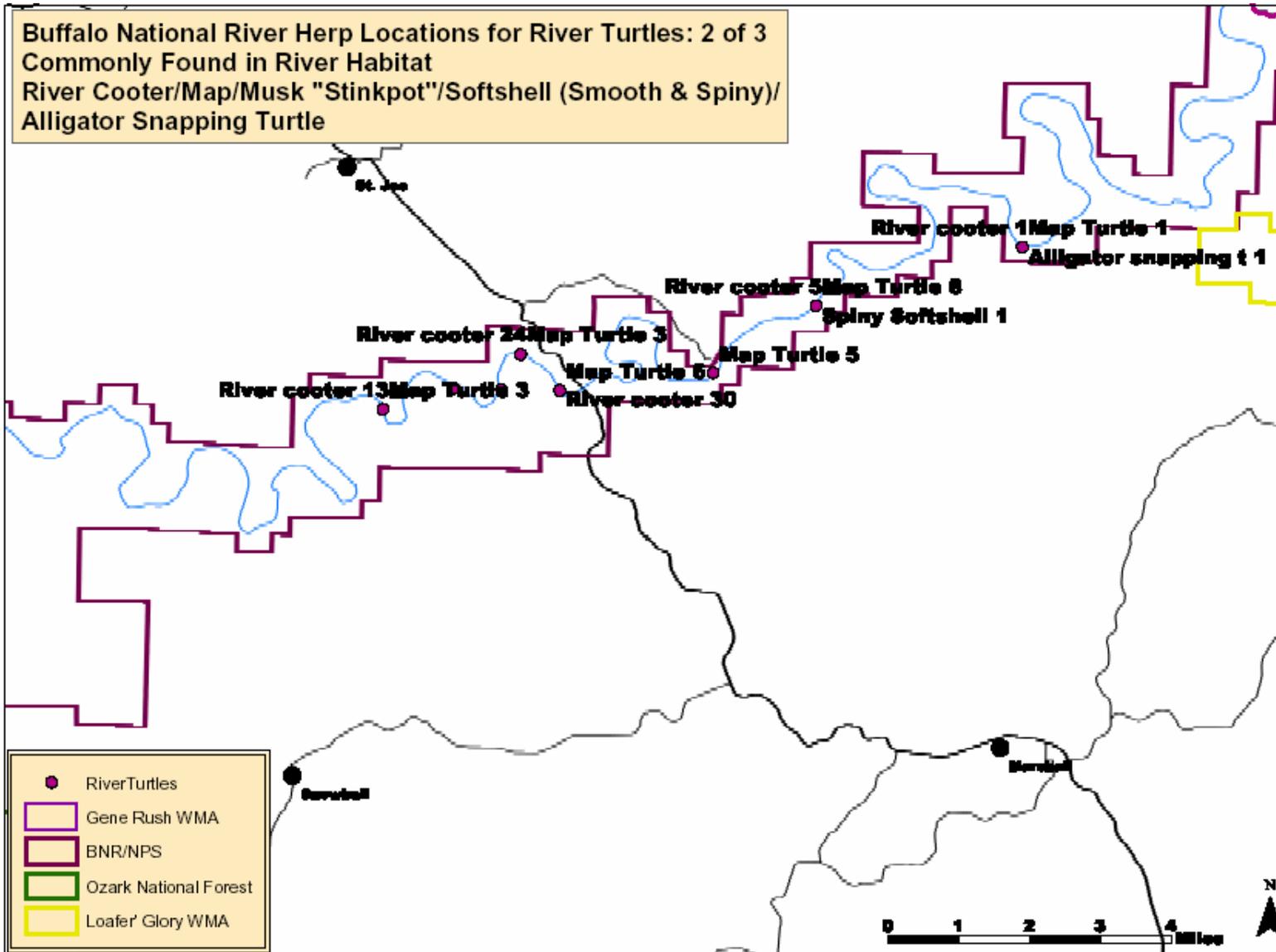


Figure 40. River Turtles 2 of 3

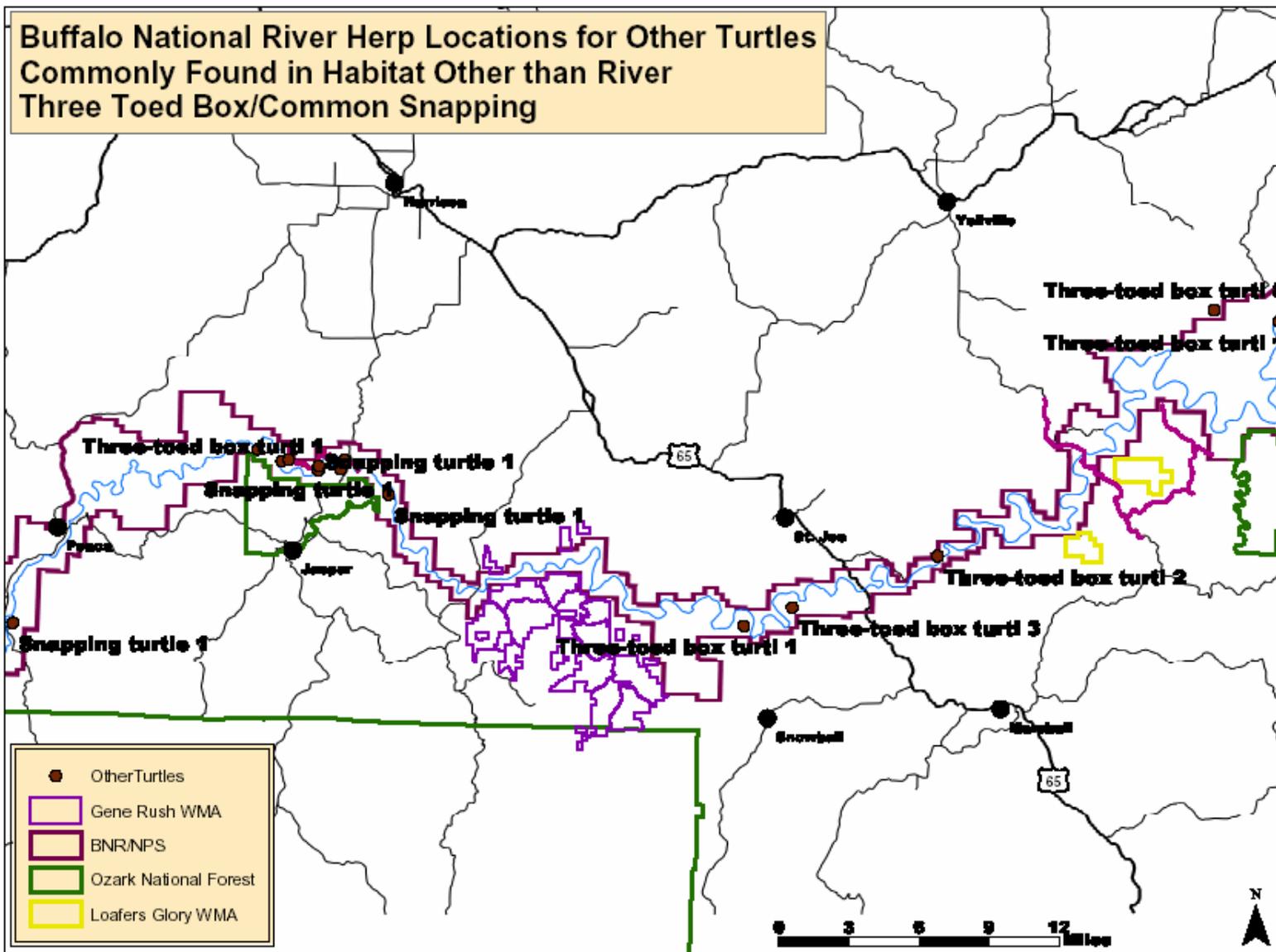


Figure 42. Other Turtles

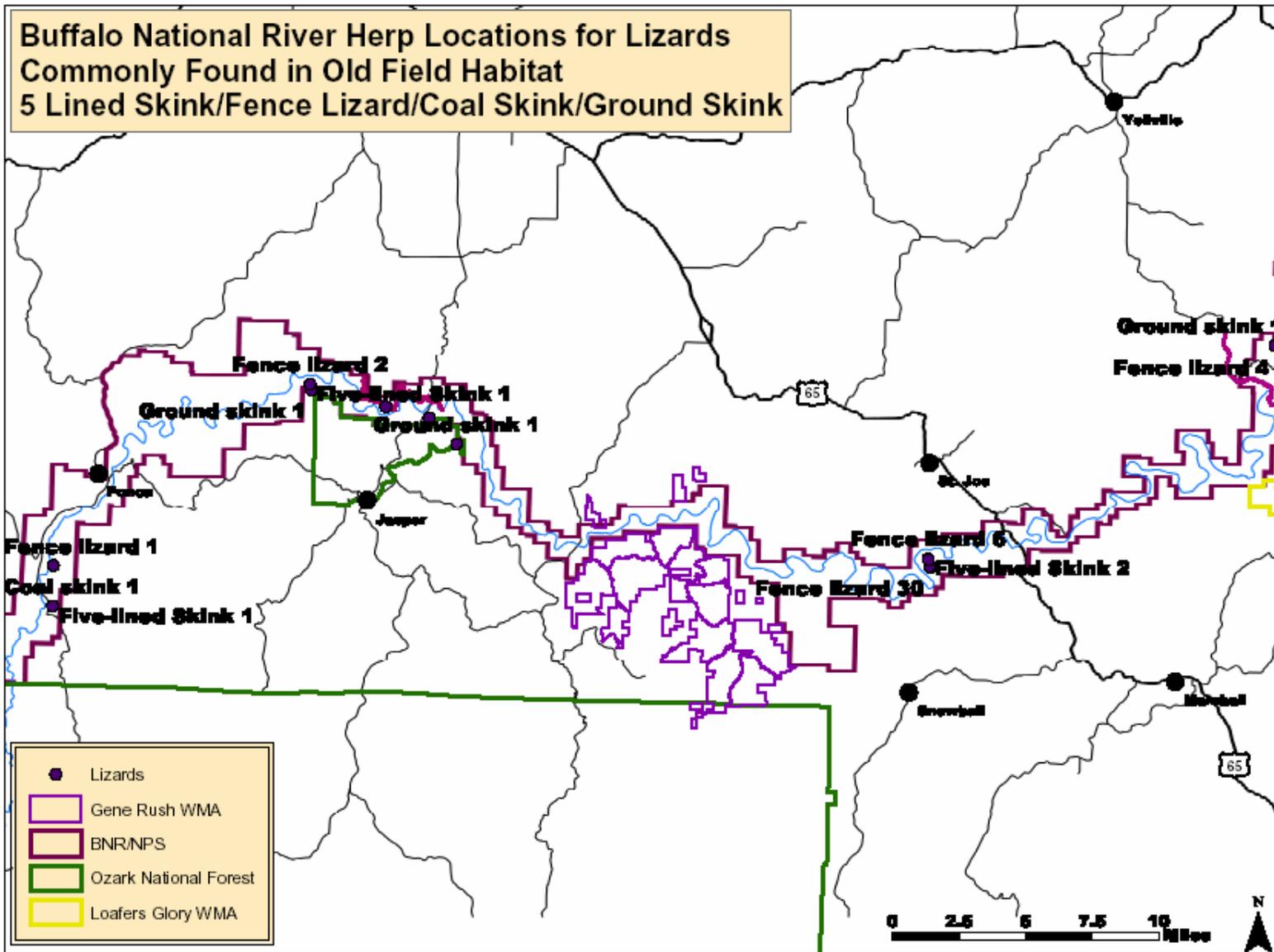


Figure 43. Lizards of Old Field Habitat

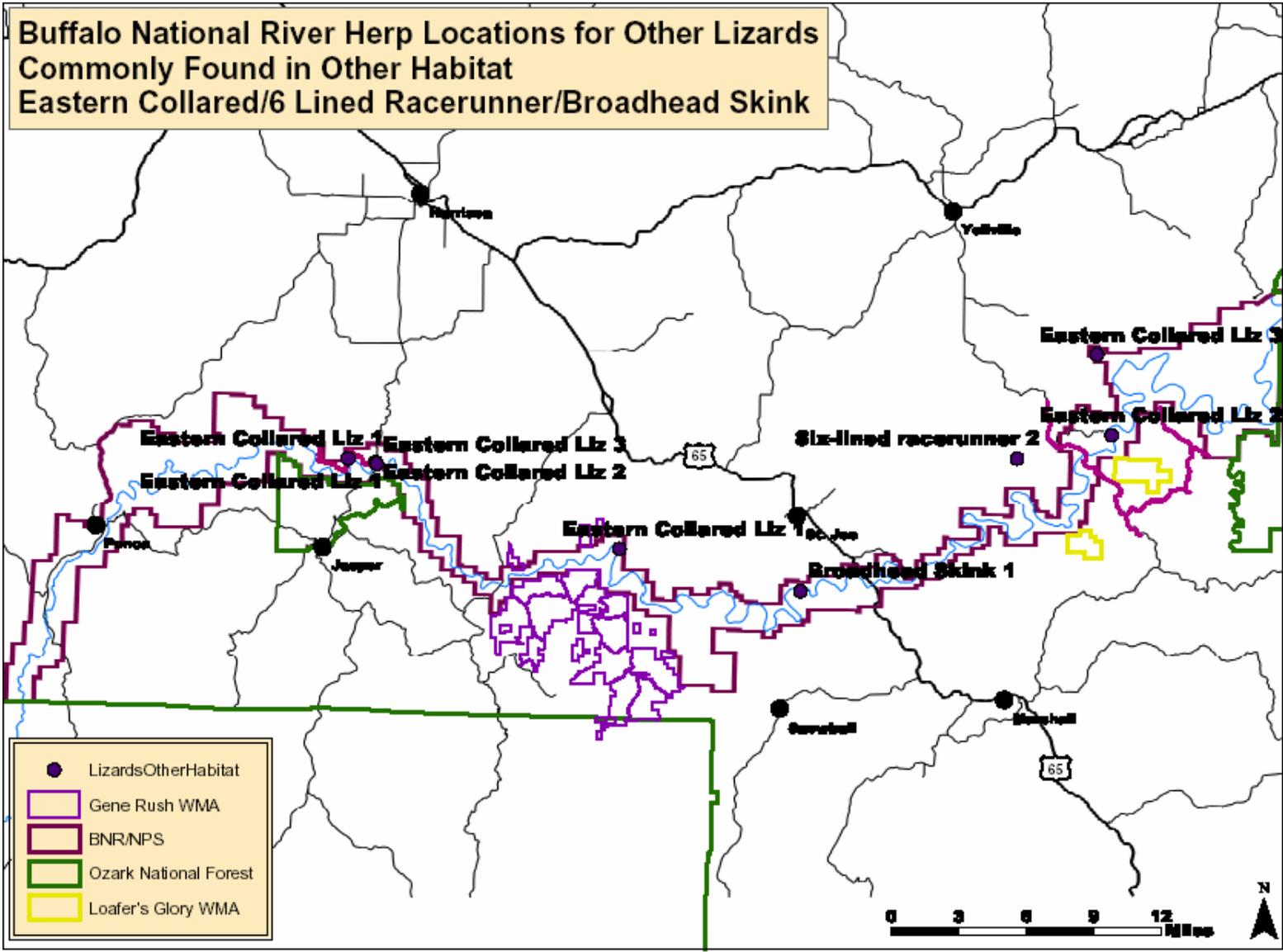


Figure 44. Other Lizards

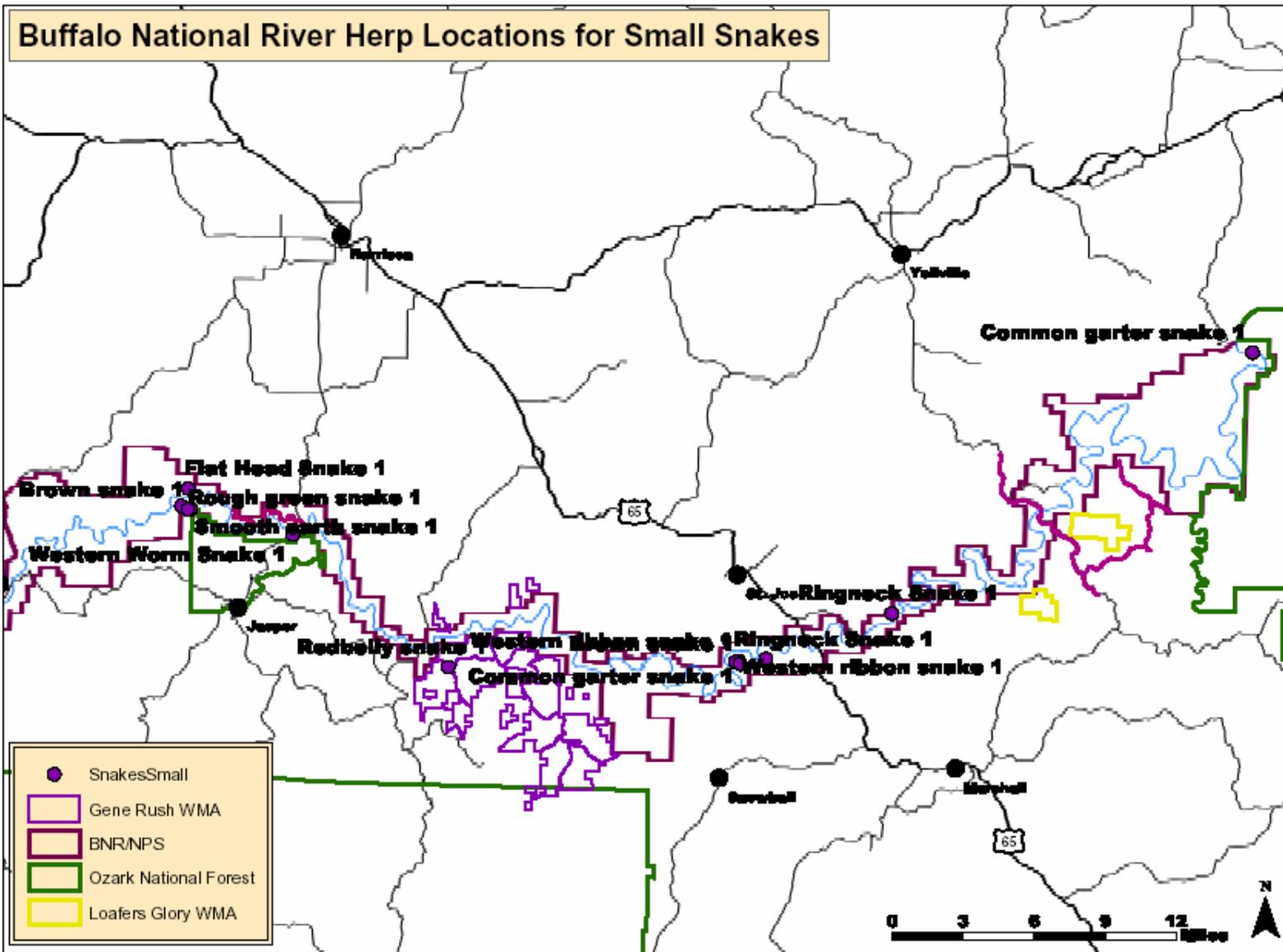


Figure 45. Small Snakes

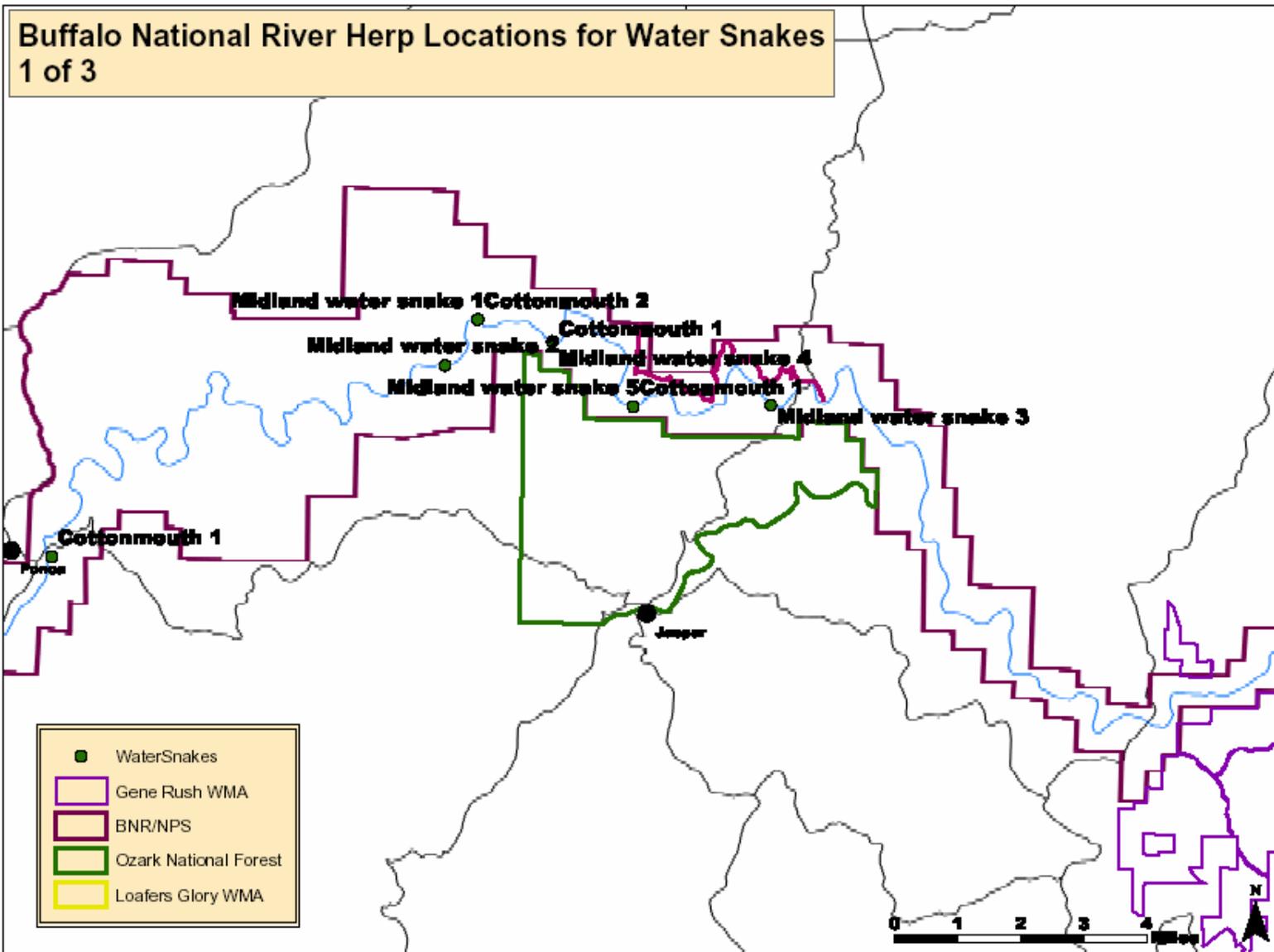


Figure 47. Water Snakes 1 of 3

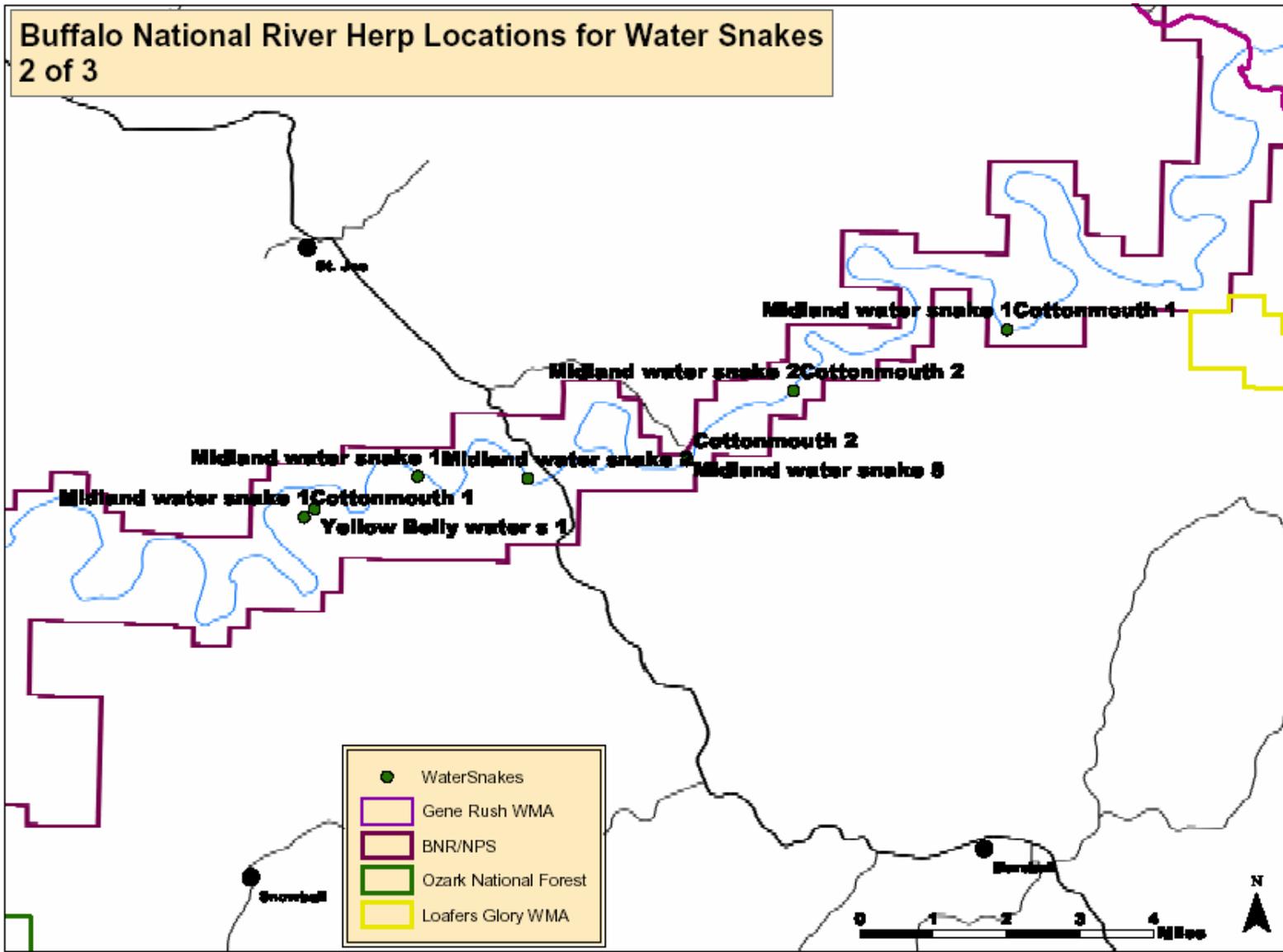


Figure 48. Water Snakes 2 of 3

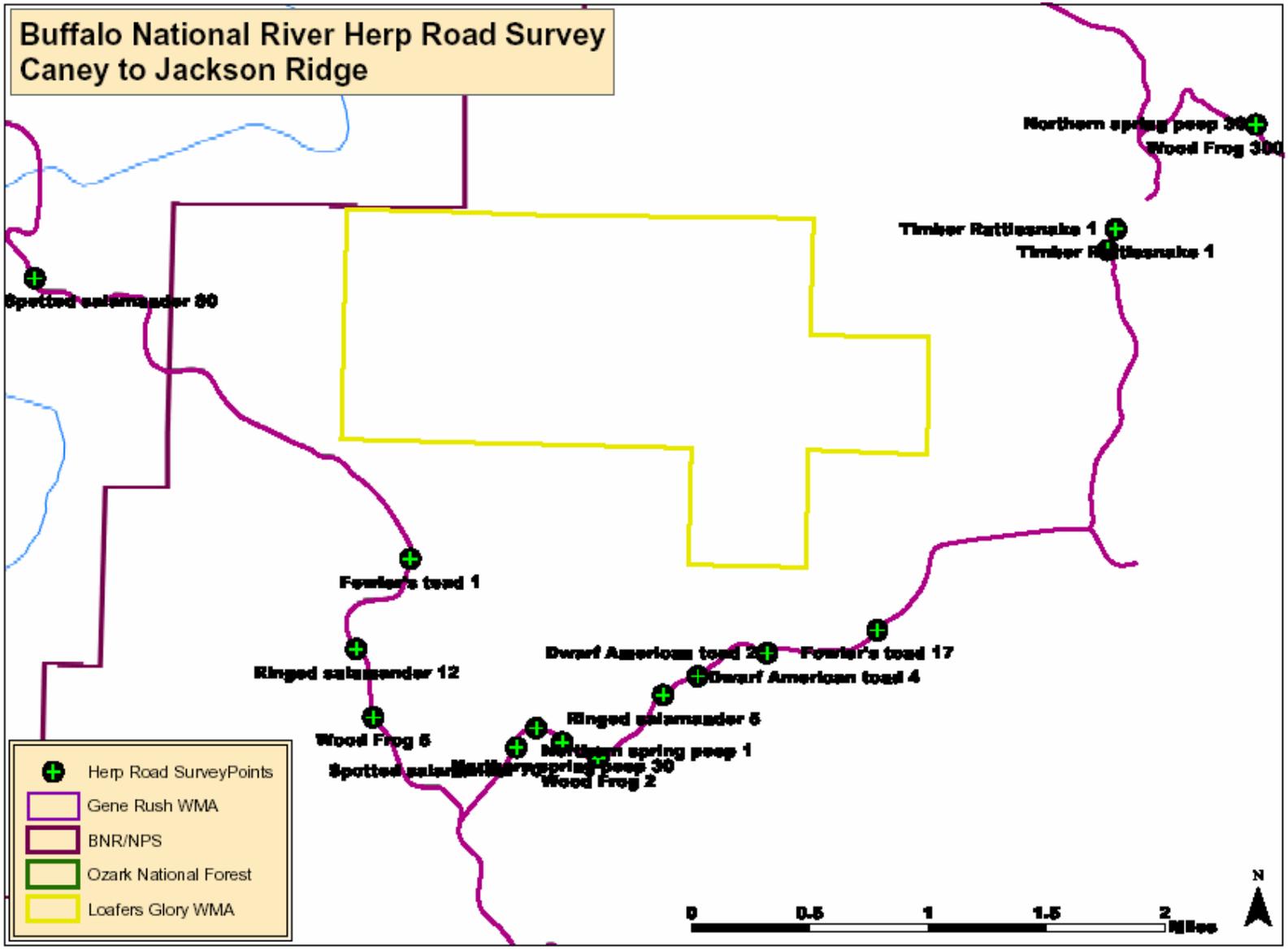


Figure 51. Caney to Jackson Ridge - Herp Road Survey

